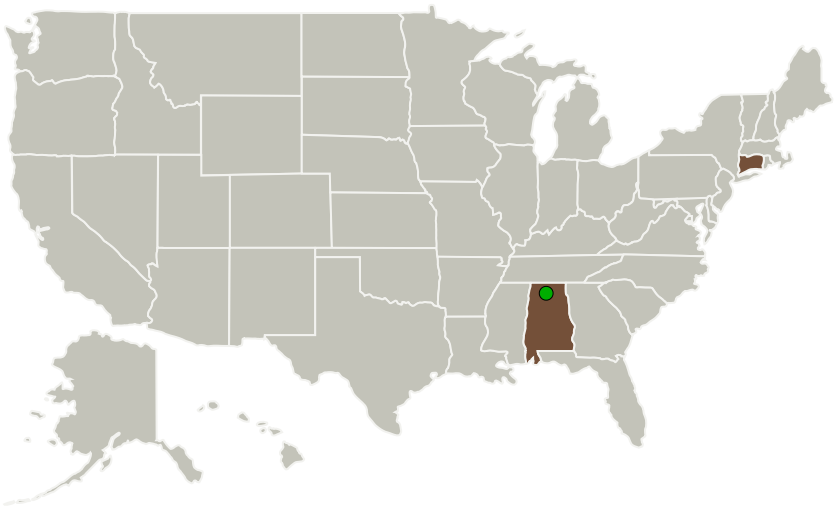
# Fabrication Technology for X-Ray Optics and Mandrels, Phase I

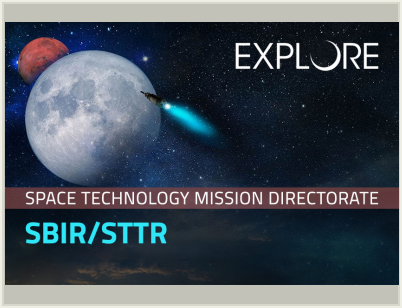
Completed Technology Project (2011 - 2011)

## Project Introduction

NASA has a cross-project need for large format aspheric x-ray optics, which, demonstrate exceptionally low periodic surface errors. Available technologies to both measure and fabricate such surfaces are limited and have not been demonstrated to the precision required. The special requirements contemplated by future x-ray observatory missions include far off-axis hyperbolic and parabolic mirror segments used in nested Wolter Type-1 x-ray telescopes. Such mirrors are to be produced by replication on convex mandrels to meet aggressive manufacturing cost goals, however doing so will require breakthroughs in process, manufacturing and testing technologies. In 2008-9, Aperture Optical Sciences Inc. designed and built a unique custom cylindrical grinding and polishing machine and delivered this machine to a customer for the automated production of cylinder optics. The machine embodied a fundamental technology that could be applied toward the low-cost production of x-ray optics mandrels including a fully scalable ⬌ large tool computer controlled platform and an algorithmic approach to figure correction using programmable motion and pressure control. Our proposed work would model the adaptation of this machine design and would model the technology and parametric machine controls required to produce full-aperture mirrors having low amplitude periods across the full power spectrum of interest.

## Primary U.S. Work Locations and Key Partners



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| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| Flemming Tinker Inc. | Lead Organization | Industry | Higganum, Connecticut |
| Marshall Space Flight Center(MSFC) | Supporting Organization | NASA Center | Huntsville, Alabama |

| Primary U.S. Work Locations | |
|---|---|
| Alabama | Connecticut |

## Project Transitions

**February 2011:** Project Start

**September 2011:** Closed out

**Closeout Documentation:**

- Final Summary Chart*(https://techport.nasa.gov/file/138150)*

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

Flemming Tinker Inc.

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

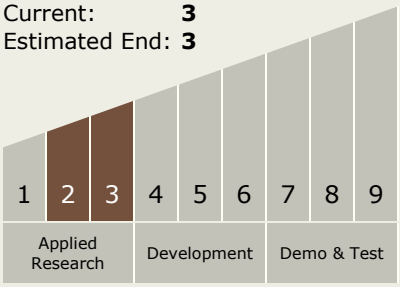
Carlos Torrez

**Principal Investigator:**

Kai Xin

## Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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## Technology Areas

**Primary:**

- TX08 Sensors and Instruments
  - TX08.2 Observatories
    - TX08.2.1 Mirror Systems

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System